Electric Improvement Company of San Jose

The Journal of ELECTRICITY POWER AND GAS

DEVOTED TO THE CONVERSION, TRANSMISSION AND DISTRIBUTION OF ENERGY.

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THE JOURNAL OF ELECTRICITY, POWER AND GAS.

Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XI. SAN FRANCISCO, NOVEMBER, 1901. NUMBER 11

Electric Improvement Company of San Jose.

PROBABLY none of the electric lighting companies of the West have undergone experiences at all comparable with those of the Electric Improvement Company of San Jose, Cal., for is there any other city of any consequence on the map wherein the rivalry which once existed between two electric lighting companies grew to such proportions as to become a fixed, if not the only, issue in the political contentions of the local commonwealth? The issue is now a dead one, however, for the Improvement company is complete master of the situation, local politics are long since restored to their usual channels, and the incident is referred to not so much as a matter of history as to emphasize the fact that the plant of the Electric Improvement Company of San Jose, however perfect it is for its purpose today, is not one of the hothouse growth and tender nuture—unless the interpretation of the vernacular be placed upon the noun.

H. J. EDWARDS, THE "KING" OF SAN JOSE.

The inception of the present plant dates from January 27, 1900, when fire destroyed the old station, consuming with it 3000 lights capacity in Slattery alternators, a Westinghouse 3000-lighter, seven Wood arc machines and one Excelsior arc dynamo. These dynamos had been in use from seven to ten years before the fire, but they were under the best of care, and in consequence were still in good condition. The old plant contained five high-speed engines, two Ball compounds of 125 horsepower each, one Ball compound of 250 horsepower, and two Westinghouse compounds of 100 horsepower each. On these pages are given miniature views of the ruins, which show the completeness of the devastation that was suffered.

In building anew, the ideas ever bourn in mind have been those toward compactness, convenience, reliability, economy and flexibility in the distribution and utilization of lighting and powerservice. The new building for the electric station is of brick, measuring 55x110 feet, its roof being of tin and its floors of concrete. It is of the best construction throughout, is of liberal dimensions for the service required and is well arranged for the installation of the boilers, engine, generator, switchboard and other ma-

FIRE COMPLETELY DESTROYED THE ELECTRIC IMPROVEMENT COMPANY'S ELECTRIC STATION ON JANUARY, 29, 1900.

chinery. The building may be extended toward the south whenever it may be found desirable to enlarge the plant.

Some three years ago a water gas plant was added to the electric equipment, and the company's grounds were early laid out with the idea of accommodating both the gas and electric plants. The location is an admirable one, being situated on the line of the South Pacific Coast Railroad of the Southern Pacific Company, so as to be accessable to both narrow gage and broad gage cars, which enter the grounds through spur tracks. The facilities, therefore, for handling fuel, whether oil, wood or coal, and also machinery and construction material, are of the very best. The oil for fuel and for the manufacture of gas is transferred from tank cars direct into the storage tanks of the company. Two iron tanks, having a capacity of about 15,000 gallons, are provided to receive the oil used for making gas, while one wooden tank, holding about 14,000 gallons, is used for storing fuel oil for the electric station. These three tanks are buried underground and provision is made for heating the fuel oil as it is pumped from the tanks to the furnaces.

THE NEW STATION OF THE ELECTRIC IMPROVEMENT COMPANY DURING THE TRANSMISSION CONVENTION.

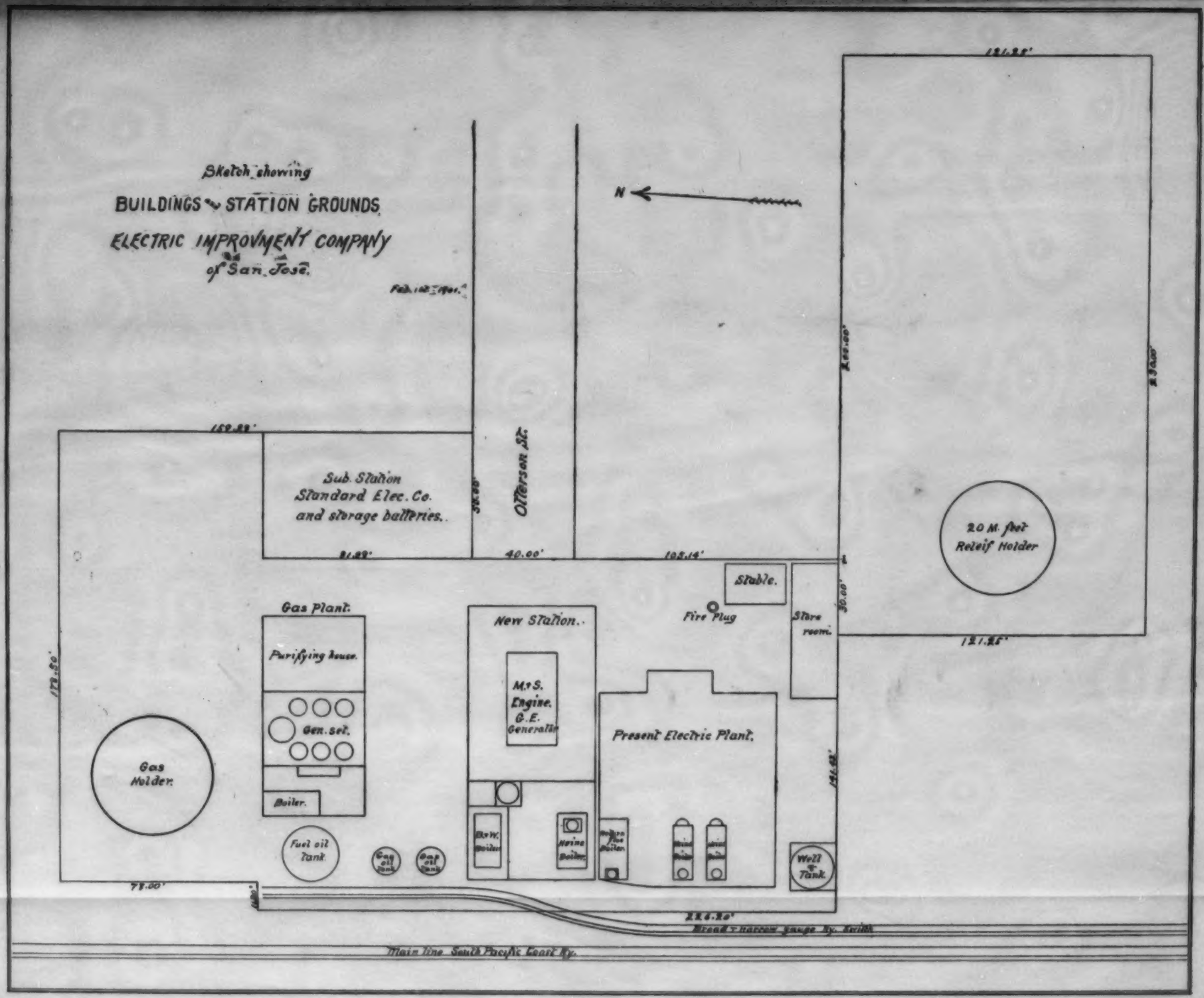
Considering the electric station first, the battery of boilers is located in the section adjoining the railroad track and separated from the engine room by a substantial fire wall of brick. In the boiler room are one Babcock & Wilcox boiler, having a rated capacity of 280 horsepower, one Heine boiler of 250 horsepower, two Heine boilers of 200 horsepower each and one round tubular Keystone boiler, having a rating of 150 horsepower (72"x6'). An ample supply of water from good artesian wells upon the company's grounds furnishes all the water used, in view of which, and for reasons which will appear, the plant is run non-condensing. Probable increase in the boiler room is provided for in building and flue capacity. Oil is burned exclusively, and steam is carried at 125 pounds.

The new engine is of the horizontal, cross compound, tail rod type, built by McIntosh & Seymour, it being their latest design. It drives through direct connection and at a speed of 100 revolutions per minute, a 400-kilowatt, 72-pole, 60-cycle, 2300-volt, three-phase General Electric generator of the revolving field type. This generator supplies current for the operation of the incandescent lighting and induction motor load, in paralliel with transmitted power, while the arc lighting system is similarly supplied by three General Electric constant current transformers, each delivering alternating current for the operation of a series of fifty, 2000-candlepower enclosed arc lamps,* the experience with which has been most satisfactory from the outset. The switchboard contains two generator panels, one of which is provided for the second generator when installed, but at present this extra panel is used to receive power from the transmission lines of the Standard Electric Company.

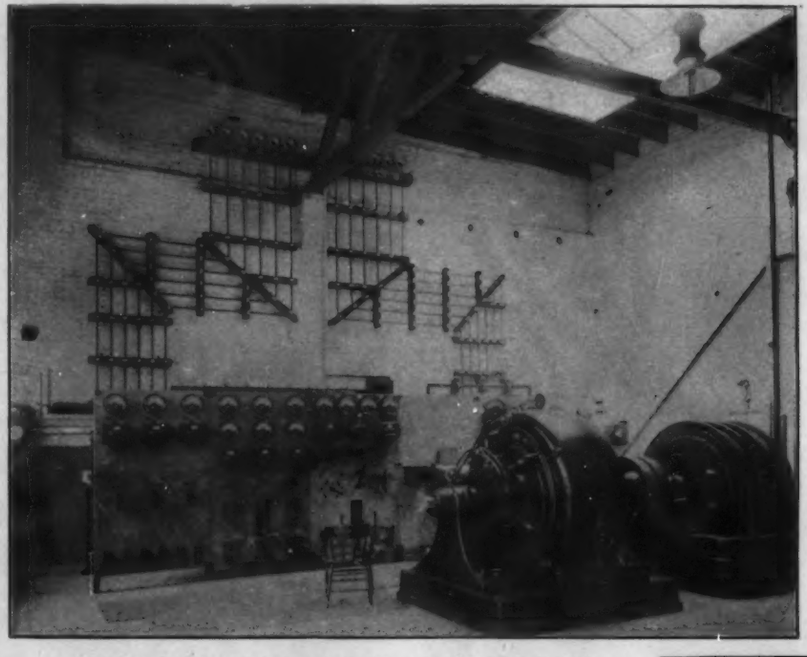
The Electric Improvement Company holds a contract with the Standard Electric Company for the distribution of electrically transmitted power from the Standard lines in and about San Jose, and the Improvement Company's station may be regarded, therefore, as representative of the most recent ideas relative to steam auxiliaries in the distribution of transmitted power. The San Jose substation of the Standard Electric Company adjoins the

*Described in Bulletin No. 4203 of the General Electric Company.

FROM THE RUINS WAS BUILT THE NEW PLANT, WHICH IS A MODERN TRANSMISSION AUXILIARY.


Sketch showing
BUILDINGS & STATION GROUNDS
ELECTRIC IMPROVMENT COMPANY
of San Jose.
N
121.25'
165.00'
150.00'
Olterson St.
Sub Station
Standard Elec. Co.
and storage batteries.
38.00'
81.22'
40.00'
102.14'
20 M. feet
Relief Holder
Stable.
Fire Plug
Store room.
30.00'
121.25'
Gas Plant.
Purifying house.
Gen. set.
Boiler.
Gas Holder.
Fuel oil Tank.
Gas oil Tank.
Gas oil Tank.
New Station.
M.P.S. Engine. G.E. Generator
Present Electric Plant.
Boiler
Boiler
Boiler
Boiler
Well & Tank.
172.50'
79.00'
224.20'
Broad & Narrow Gauge Ry. Tracks
Main line South Pacific Coast Ry.

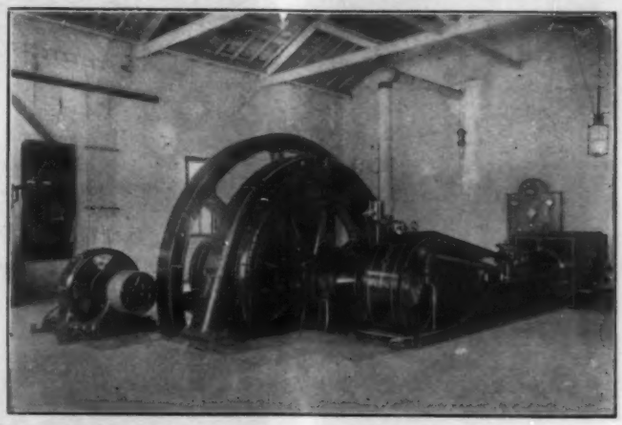
Improvement Company's station, and it is really a scene of greater activity than the latter, for the modern tendency is toward the buying of current in bulk from a transmission source rather than the manufacturing of it by a steam plant. The substation contains 300 kilowatt transformers, having primaries interchangeable from 40,000, 50,000 or 60,000 volts, and delivering 2300 or 4000 volts in star connection, two Stanley-Northern generator sets having capacities of 150 kilowatts and 200 kilowatts respectively; and also a storage battery consisting of 270 "G" type cells of the Electric Storage Battery Company, each cell containing thirty-three plates, with provision for ten additional plates. The motors of the motor-generator sets take three-phase current at 4000 volts and their generators deliver direct current at 550 volts or thereabouts for street railway and direct current



THE SAN JOSE SUB-STATION OF THE STANDARD ELECTRIC COMPANY.

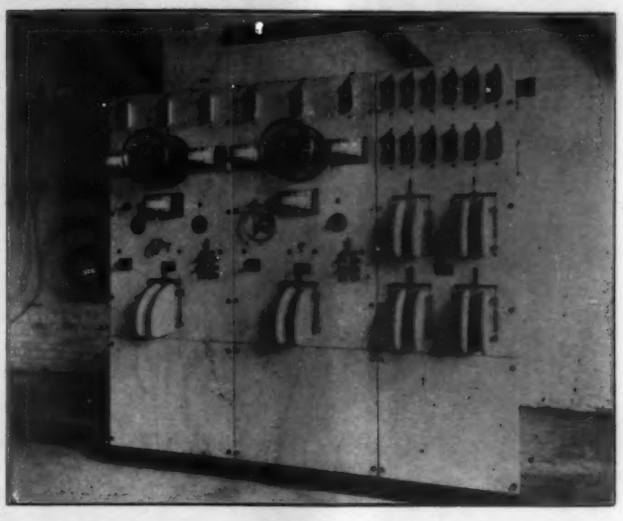
power service. To distribute this power, the Improvement Company has built some thirty miles of pole line (exclusive of the poles of the street railway lines), upon which it is operating about 150 miles of wire for any kind of day or night service. Both the railway systems and all the electric motors of San Jose are run from the Improvement Company's circuits.

Coming now to the Improvement Company's gas plant: it contains two 5-foot sets with 10-inch connections and having a capacity each of from 175,000 to 200,000 cubit feet of gas per diem. Improved Lowe water gas apparatus is used, one set of which was built by the Western Gas Construction Company, while the other set was built by the Improvement Company's engineer upon the ground. The relief holder has a capacity of 20,000 feet, while that of the main holder is 30,000 feet, and the feature of the latter is that it can be telescoped. All parts of the gas making machinery are in duplicate, including engines, blowers, pumps, etc. Service is given to nearly all parts of the city through about 75,000 feet of standard gas mains.



UP-TO-DATE IN EVERY WAY.

Thus does San Jose rank foremost among the cities of California in its recognition of the most recent trend of electrical engineering development. It was quick to grasp the advantages of electrical transmission; it was ready, after the shortest deliberation, to modify and reconstruct its system throughout in accordance with modern engineering methods, and today it has earned the distinction of possessing an electric lighting and power system which may be regarded as symbolizing that which is the latest and best in American electric practice. The administration of the affairs of the Improvement Company has been in the hands of Mr. H. J. Edwards, its general manager, since the inception of the company. Mr. F. M. Pickering is president, and Mr. Sidney Sprout is consulting and supervising engineer.



COMPACTNESS IS THE CHARACTERISTIC OF THE SWITCHBOARD.

THE LINCOLN SYNCHRONIZER.

BY R. S. MASSON.

THE ideal synchronism indicator should perform three distinct functions:

First—It should indicate the exact point of synchronism or coincidence in phase between the bus-bars and the incoming alternator.

Second—It should indicate whether the incoming alternator is running too fast or too slow.

Third—It should indicate the amount the incoming machine is too fast or too slow.

Synchronizing lamps, such as are ordinarily used, perform the third function perfectly, the first only approximately, and the second not at all.

The Lincoln Synchronizer performs all three functions perfectly. This synchronizer is so made as to actuate a a hand moving around a dial—like the hand of a clock—so that the angle between the hand and the vertical is always the phase angle between the two sources of electro-motive force to which the device is attached. If, therefore, the incoming alternator is running too fast, the hand rotates in one direction, and if too slow, in the opposite direction. Coincidence in phase occurs when the moving hand stands vertically. A complete revolution of the hand indicates a gain or loss of one cycle in frequency of the incoming alternator as compared with the bus-bars.

LINCOLN SYNCHRONIZER.

Only those who have actually passed through the experience of "throwing in" alternators can appreciate the advantages of having an exact indication of phase coincidence instead of being obliged to do more or less guessing, as is the case with the ordinary synchronism indicator.

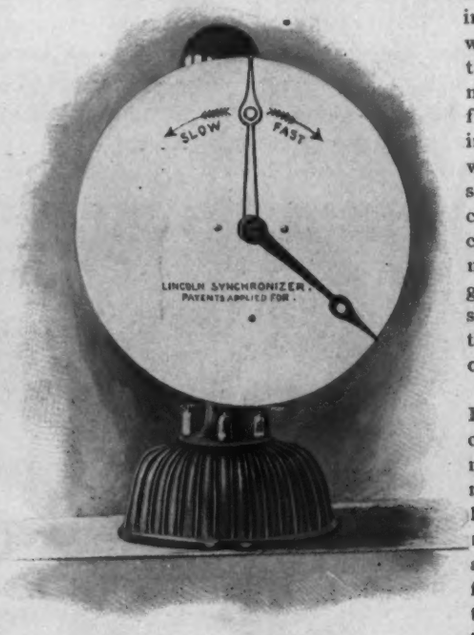
Particular attention, however, is called to the fact that the Lincoln synchronizer indicates whether the incoming machine is running too fast or too slow. No other indicator on the market does this. The time-saving possibilities of these features can be appreciated only by those who have used it.

Since its adoption by the Niagara Falls Power Co., the time required to parallel one of their 5000-horsepower dynamos has been reduced to about one-third or one-fourth that previously required. A minute or two of time saved in getting another alternator or rotary converter at work might be worth many times the cost of this synchronizer.

The synchronizer has been put up in the forms shown because they were thought to be the best forms for adaptation to existing switchboards. The instrument is provided with a swivel, so that the dial can be rotated a distance of about 120 degrees without disturbing the base. A separate instrument for each alternator to be synchronized is not required. A single instrument can be used for any number of machines. The synchronizer can either be located at some central point, and thrown on to different machines by small switches, or it can be used as a portable instrument, and connected by portable leads to any desired points.

The diameter of the dial is 12 inches. It is made this ample size so as to be capable of being observed by the attendant regulating the speed of the engine or water wheel driving the incoming alternator, as well as by the switchboard attendant. The current taken by either of the two elements of the device is considerably less than one ampere, so that current for operating may be taken from voltmeter transformers where desired. The instrument is wound for use on a 100- to 120-volt circuit. Instruments will be wound for other voltages on special order. In ordering, state frequency.

Every one who runs a plant should investigate this instrument. On a test at a San Francisco plant a rotary transformer was thrown in twenty times in two minutes without moving the ammeter needles away from the stops in but two cases, when they only swung to .03 per cent. of full load current of the machine. On generators results equal to these are easily obtained.



LINCOLN SYNCHRONIZER.

To install the Lincoln synchronizer, connect the terminals marked B1, B2 to the 100- to 125-volt side of a suitable transformer attached to the bus-bars to which a machine is to be connected. Any transformer wound for bus-bar primary voltage, which will give a one ampere, 110-volt to 125-volt secondary current, is suitable.

Connect directly, or by set of switches, the terminals marked D1, D2 to the incoming machine by a similarly suitable transformer, having primary circuit wound for machine voltage and secondary for 100 to 125 volts. A switch should be installed on each side of the instrument, to cut it out until the generator is nearly up to synchronism, and when not in use. The instrument is then ready to use.

The dial may have been removed or moved in shipment. To determine if it is connected in the proper direction (the hand may be up or down if not noted), throw the machines in multiple by lamps, or start them from a standstill, connected in multiple, with field closed. This should be done with everything—all included transformers, etc.—connected in the exact manner in which they will be when running in multiple in regular use. The pointer should then point vertically upward. If it points vertically downward, reverse D1 and D2; if it points in any other direction, loosen the set screw in the hand, and move it around until it remains vertically upward—over its image on the dial. This must evidently be the proper point to "throw in" on. Care should be taken to give the rotor $\frac{1}{32}$" to $\frac{1}{16}$" end play in placing the hand, the hub of which acts as a collar for holding the shaft in position. Place a 16-candle-power 110-volt lamp in the socket on the machine.

The writer, who holds the Pacific Coast agency of the Lincoln synchronizer, will be glad to give any further information concerning it to all who may address him at his office, No. 321 Market street, San Francisco.

"THE JOURNAL makes very interesting reading," writes the Rutland Street Railway Company of Rutland, Vt.

Echoes of the Transmission Convention.

ALTHOUGH it is some time since the Pacific Coast Electric Transmission Association adjourned in its fifth annual session at the Hotel Vendome, in San Jose, interest in the event has waned so little that, despite the intervention of many weeks, a perhaps extended reference to its distinguishing features will be of interest. It is but fifty miles or so from San Francisco to San Jose — miles which excellent train service make brief — and the arrival at Hotel Vendome was timed to allow preparation for an early luncheon in order that the business of the Convention might be begun shortly after noon. First impressions are lasting ones, and now, in looking backward, one remembers so gratefully the beautious surroundings of the place selected for the fifth annual convention — its lawns, its trees, its flowers, its quietness and seclusion and, to many, more than all these, its perfect appointments, possessed as they were of all the comforts, conveniences and luxuries of modern hoteldom.

THE VENDOME LOBBY AND BANQUET HALL.

The sessions were held in the assembly room of the hotel and they were characterized by a uniformly large and interested attendance. Readers of THE JOURNAL are already familiar with the papers which were presented for discussion, as they have appeared in these columns during the past four months, nevertheless a review of the convention and its work would be incomplete without a reference to them. They are on the following subjects:

"The Possibilities and Limitations of Electrically-Transmitted Power in Pumping Duty," by Lewis A. Hicks, C. E.[1]

"Phenomena Attending the Use of Telephone Circuits Over Electric Power Transmission Pole Lines," by Theo. E. Theberath, M. E.[2]

"Details of the Standard High Tension Pole Line Construction," by C. O. Poole.[3]

"Suggestions in High Tension Switching," by R. S. Masson.[4]

"Details of the Bay Counties' Pole Line Construction," by C. E. Dutcher.[5]

"The Latest General Electric Types of Switches," by H. C. Wirt.[6]

"The Latest Westinghouse Types of Switches," by W. M. McFarland.[7]

"Anent the Telluride 40,000-volt Switches," by V. G. Converse.[8]

"Switching Experiences of the Central California System," by R. W. Van Norden.[9]

1 *Vide* THE JOURNAL, Vol. XI, page 216, September, 1901.
2 *Ibid*, page 168, July, 1901.
3 *Ib.*, page 185, August, 1901.
4 *Ib.*, page 117, June, 1901.
5 *Ib.*, page 195, August, 1901.
6 *Ibid*, page 137, June, 1901.
7 *Ib.*, page 133, June, 1901.
8 *Ib.*, page 141, June 1901.
9 *Ib.*, page 120, June 1901.

"The Martin High Potential Switch," by F. V. T. Lee.[10]

"Fifteen-thousand-volt Switches in the San Gabriel Transmission," by Phil. S. Taylor.[11]

"Climatological Influences and Electrical Transmission," by Prof. Alexander G. McAdie.[12]

"Breaks 800 Kilowatts at 15-000 Volts," by Lem S. Boggs.[13]

"Switches Not Opened Under 'Shorts,'" by Max Hebgen.[14]

"Experience of the San Joaquin Electric Company," by John S. Eastwood.[15]

"Some General Experiences in High Tension Switching," by Robert McF. Doble.[16]

These papers, together with discussions upon them, are now ready for distribution, having been printed in the customary form as the Transactions of the Fifth Annual Convention of the Pacific Coast Electric Transmission Association. It forms a superb book of 209 pages, and may be obtained by non-members at the price of one dollar per copy.

A portion of the afternoon of the first day was devoted to the executive session of the association, during which the California Central Gas & Electric Company, the Shasta Electric Light & Power Company, the Southern California Power Company and the Keswick Electric Power Company were elected to full membership. The companies and individuals which were elected to associate membership were the Stanley Electric Manufacturing Company, the Wybro-Hendy Company, Chas. C. Moore & Company, George E. Carter & Company, and Messrs. A. W. Burrell, C. E. Dutcher and Leon M. Hall. But one name was added to the list of honorary members, and that was the name of William R. Eckart, whom all recognize as among the very foremost of the engineers of the Pacific Coast.

Owing to the absorption of the Redlands Electric Light and Power Company by the Edison company of Los Angeles, and to the fact that the Edison company is already a member of the Association, the resignation of the Redlands company was received and accepted. Officers for the ensuing year were elected as follows: President, Dr. Chas. Van Norden, president of the Central California Power Company; Vice-President, E. J. de Sabla, Jr., president of the Bay Counties Power Company; Treasurer, William Angus, secretary of the Standard Electric Company of California; Secretary, Geo. P. Low, editor and proprietor of THE JOURNAL; Members of the Executive Committee, Messrs. H. H. Sinclair and John Martin.

A few further actions of general interest were taken. For instance, the treasurer was authorized to sell the Association badge or button to eligible members at cost; a "Wrinkle Department" was instituted for the collection and dissemination of useful ideas pertaining to transmission work and it was ordered that the administration of the same be placed in the hands of Mr. C. W. Hutton during the ensuing year, and finally a resolution was adopted declaring it to be essential to the welfare of the Association that the Executive Committee be called in meeting on the second Monday in March of each year, and as often thereafter as necessary, to perfect arrangements for the program upon which the Annual Convention, to be held in the ensuing June, will be carried out.

IN THE GROVE AT ALUM ROCK PARK, NEAR SAN JOSE, CAL.

Owing to the great amount of business to be transacted by the Association in a limited time, it was decided to hold the banquet at 9:30 p. m., of the first day's session, instead of at 6 p. m., as originally proposed. A light supper was, therefore, partaken of at 6 o'clock, immediately after which the Convention gathered in the Assembly room to listen to the reading of the papers which were illustrated by the stereopticon. These papers were those of Prof. McAdie, on climatological influences pertaining to electrical transmission, and of Messrs. C. O. Poole and C. E. Dutcher on the features of construction of the pole lines of the

10 *Vide* THE JOURNAL, Vol. XI, page 121, June 1901.
11 *Ib.*, page 140, June 1901.
12 *Ib.*, page 209, September, 1901
13 *Ib.*, page 132, June, 1901.
14 *Ibid*, page 136, June, 1901.
15 *Ib.*, page 139, June, 1901.
16 *Ib.*, page 140, June, 1901.

Standard Electric and Bay Counties' systems respectively. Of these, especially beautiful were many of the cloud and fog effects which were thrown on the screen from Prof. McAdie's superb collection of lantern slides. The evening session was fully attended by the ladies of the convention, who evidenced the heartiest appreciation of the proceedings.

Promptly at 9:30 p. m. the guests entered the banquet hall to the strains of Prof. Lowinsky's most excellent orchestra, hidden away amid a bank of ferns and palms in a corner of the hall. The table was arranged in the form of a great horseshoe, its head being occupied jointly by the retiring President, Pce. Ponitowski, and the Vice-President-Elect, Mr. de Sabla, acting in the absence of the President-Elect, Dr. Van Norden. The assemblage was a brilliant one, the service was superb and the after-dinner speech-making of sage advice and witty repartee carried the merrymaking far into the morning hours.

A LOW LAUGH.

The "electric transmitters," as a local paper dubbed the members of the Convention, were not early risers on the following morning, as they had consumed more than the midnight watt on the previous evening, so the convention did not re-assemble on the scond day until nearly 10 o'clock. The final adjournment was taken at 11:45 a. m., when the entire assemblage, together with the ladies of the party, and a goodly number of the most prominent people of San Jose, took the special cars in waiting at the main entrance to the hotel grounds and started on the six-mile ride to Alum Rock—first as the guests of the San Jose Street Railway Company, which, by the way, honored the Association badge for free transportation over the lines of its entire system, and then, at Alum Rock, as the guests of the Electric Improvement Company of San Jose. Before proceeding to Alum Rock, however, the party was taken to the new gas and electric station of the Electric Improvement Company, as well as to the San Jose substation of the Standard Electric Company of California, which adjoins the Electric Improvement Company's plant. A description of these stations appears as the leading article of this issue. This visit in itself was one of no mean significance, for it officially marked the successful inauguration of the longest distance electric power transmission the world has ever seen. As readers of THE JOURNAL are well aware, pending the completion of the waterways of the Standard Electric Company, power for its lines about the Bay of San Francisco is being taken from the circuits of the Bay Counties Power Company at Oakland, and as the latter derives its power from the great Colgate power house, 142 miles distant, the total length of line between Colgate and San Jose is 184 miles. Practically all of the electrical industries of the Garden City, as San Jose is aptly called, are operated from the station of the Electric Improvement Company--for the system of its only competitor, the San Jose Light and Power Company, is almost inconsequential. Thus was it that the attendants to the Convention were carried to the suburbs of the city in electric cars pulled by Colgate power, and thus was it that their ways at night were lighted by Colgate power, with the single exception that, with singular perversion, it so happened that the hotel itself was lighted by the steam plant of the local competing company. At the easterly limits of the city, the guests were transferred to special trains of the steam motor road running thence to Alum Rock Park—a select and delightful canyon of mineral springs and luxurious foliage. After an hour or so had been spent about the grounds, the assemblage was "lined up" by the well-known photographer of San Jose, Mr. A. P. Hill, and the photograph resulting from the process, and which is reproduced in the preceding page, forms a valued souvenir of the occasion.

A SHORT-CIRCUITED ARGUMENT.

AVOIRDUPOIS AND BUOYANCY RACE UP HILL.

A BUNCH OF "ELECTRIC TRANSMISSIONERS" AT ALUM ROCK.

Those who know the Electric Improvement Company have long since realized that it never does things by halves, for its affairs are in the hands of men who know full well how to season very necessary business sagacity with the exquisite condiments of genuine hospitality which is so proverbial of them. In becoming modesty, they extended an invitation to the Conventionites to take "luncheon" with them, but that "luncheon" proved to be a feast of no mean proportions, for with every course in keeping with the Eastern oysters on the halfshell at its beginning, and its sparkling wines at its ending, naught further could be desired by the most exacting epicure. And, speaking of wines, how little the Californian appreciates the virtues of his own state. How few of us have ever beheld the beauties of Yosemite, secluded at our very doors, and how many of us know the delectable qualities of Paul Masson's product—that Yosemite of champagnes, ripened and aged there at San Jose, so very near by. Thanks to the hospitality of the Electric Improvement Company, the "electric transmitters" know of it, as they also know that there "will be something doing" whenever the bountiful entertainment given by President Pickering and Manager Edwards in the memorable trip to Alum Rock Park is surpassed.

After refreshments J. O. Hayes, the toastmaster, gave an address of welcome in behalf of the Improvement Company, and then called upon Judge Bond. The Judge, in his customary happy vein, complimented the Association on what it had accomplished in the way of long distance transmission, and spoke of the possibilities of such transmission.

Alfred Holman, proprietor of the San Jose *Mercury*, was next called upon. Mr. Holman said it gave him pleasure to endorse the cordial words of welcome to San Jose given by those who had preceded him. "The thing we celebrate today," he said, "is truly a marvel, and it is a marvel which promises much for the future welfare of the Santa Clara valley, for with our adjacent water powers there is no limit to what the future may yield us, through the agency of electric force, in the way of material development." Mr. Holman spoke appreciatively of the energy and capital expended in the great enterprise, adding the remark that San Jose and Santa Clara county had no sympathy for those communities which maintained the attitude of hostility towards capital. "You will find," he said, "that capital invested in enterprises of this kind will have with us the same consideration and protection as capital

invested in trees and vines." A. T. Herrmann, civil engineer of San Jose, spoke humerously on the possibilities of long distance transmission and called attention to the improvements that had taken place in this line, and seemed to be of the opinion that if we could carry a current 200 miles now the day would soon come when it could be carried 2000 miles.

The next speaker was George Center, President of the Alum Rock Railway, who started out on electricity, but soon left that subject and switched off onto the "park." He commented on the natural advantages of the park, which, if properly improved, would make one of the finest on the coast.

J. E. Richards was next introduced. Mr. Richards spoke of the birth of applied electricity with Franklin and Morse, and their labors and triumphs. And that their successors in the field were our contemporaries today, the men who have made real the dreams of Franklin and Morse, and are achieving the mightiest results in electrical engineering and pointing out the pathway for still greater achievements. Mr. Richards called attention to the fact that if what has been already accomplished had been hinted at half a century ago they would have been thought the vagary of a lunatic, and that even a quarter of a century ago the idea of transmitting electrical energy over 184 miles of space would have been scoffed at. Mr. Richards also added that he thought it was within the possibilities of American genius that we should, for traveling, at some time in the future spurn the earth and ascend into the air, and from the air itself obtain our power.

PRESIDENT DR. CHARLES W. VAN NORDEN

C. O. Poole responded to a call with a few words very complimentary to San Joseans. Before he sat down he called on Prince Andre Poniatowski. The Prince said that "with or without wires he could not speak at all," but the few words that he said did not carry this out. He placed a great deal of credit as due to the people of San Jose in their courage in taking their share of the risks involved in carrying out successfully any long distance transmission scheme. Some of the difficulties which they had to contend with were mentioned. He lamented the fact that when some great improvement was started that usually too much energy was expended in fighting. But San Joseans could be proud of the good feeling they had shown towards all improvements, and said that such a feeling as this was indispensable for the welfare of a new country.

In the absence of President C. W. Van Norden of the Association, Vice-President E. J. de Sabla, Jr., said a few words for the Association, thanking the Electric Improvement Company for the entertainment provided and the many courtesies extended to them. He called for John Martin, who said that although they were at a picnic it was no picnic to build a long distance plant, and that when he first talked "long distance transmission" his friends thought him insane. Mr. Martin has lately visited many of the smaller towns throughout the State and he called attention to the many extensive experiments that had proved a failure by an attempt to install plants without investing sufficient initial capital. The object of the Pacific Coast Electric Transmission Association is to prevent such errors in the future. He also spoke of the great care which should be shown in selecting water supplies for power, and gave data concerning the source of the Standard Electric Company's power. They have a 1400-feet head of water with a daily supply of 64,000,000 gallons. He expressed his personal thanks to the Electric Improvement Company, the stockholders, and citizens of San Jose.

C. O. Poole, being again asked for a few words, spoke of the extent to which electricity could be employed after it had been transmitted. It could be applied not only to our industries, but also on the ranches for domestic uses. He extended his compliments to F. M. Pickering, President of Improvement Company, and wanted to hear from him. Mr. Pickering called attention to the fact that since electrically transmitted power had reached San Jose he did not see the use of the city building a plant, as the mayor had promised he would. He hopes to be able to prove that it is not needed. He extended the invitation to meet again at Alum Rock.

Toastmaster Hayes asked Mr. Poole to act, as he knew the names of those present. The new toastmaster called for R. S. Masson, after whom George P. Low was called for. Mr. Low said that he thought that it was time to enjoy the beauties of the park. His suggestion was acted upon and the memorable "lunch" ended.

But it must not be assumed that all the pleasures of the afternoon at Alum Rock Park were of an epicurean nature, for business was cast to the winds just as far as it is possible for electrical people to cast it. They will "talk shop" more or less on all occasions, but despite this pardonable breach of genuine rustication, all forsook restraint and enjoyed the outing just as though the world held naught of seriousness. When Theberath, for instance, took issue with Masson on matters pertaining to transmission telephony, the two disputants became involved in a transposition at arms which reached a climax at the moment when Masson pulled Theberath's nose. And then the camera caught them! The next event of interest was the race up a slope of slippery grass between Heavyweight Edwards, who did the honors on behalf of the Electric Improvement Company, and Lightweight McAdie, who tells us so much we don't know about the weather and things. Pools sold about a million to seven-tenths on McAdie, but the way Avoirdupois Edwards demonstrated the adhesiveness of things material and puffed up that slippery hill was an undreamed-of revelation. One would not have thought that Mine Host Edwards—*host*, mind you—would have been so ungenerous as to send so prominent a guest down to ignominious defeat, but he did, and the "bookies went busted."

And so the afternoon passed all too soon, for at 4 o'clock the special trains took the merrymakers back to San Jose, arriving there in ample time to enable those who chose to take the 5:35 train back to San Francisco, thus ending the most enjoyable convention that the Transmission Association has yet seen.

In conclusion, it may be added that the Fifth Annual Convention of the Transmission Association will long be remembered as a most successful one from every standpoint, and it is safe to say that it will be hardly probable that any future gathering will eclipse the social features of the one which proved so enjoyable at San Jose. In this, however, the Association is but emulating the example and custom of the Eastern electrical conventions,

THE ASSEMBLY ROOM AT HOTEL VENDOME.

which have long since settled down to a practical recognition of the principle that work should be tempered with play.

A complete list of those who attended the Convention, together with the menu of the banquet at Hotel Vendome, on the evening of the first day, follows:

Andrews, W. C.
Angus, Mr. and Mrs. William
Babcock, Mr. and Mrs. Allen H.
Baldwin, Dr. C. G.
Baum, F. G.
Biffins, T. E.
Bond, Judge H. G.
Bowden, W. A.
Briggs, Mr. and Mrs. W. W.
Center, Hugh
Center, George
Carter, Geo. E.
Cherrie, J. J.
Clark, Tom S.
Clayton, Ed.
Cole, John R.
Copeland, Prof. and Mrs. C. A.
Cory, C. L.
Cozzens, George
Darby, A. L.
de Sabla, Jr., E. J.
Doble, Mr. and Mrs. Robt. McF.
Dutcher, Mr. and Mrs. C. E.
Edwards, H. J.
Gilbert, C. P.
Hancock, L. M.
Hanscom, W. W.
Hayes, E. A.
Hayes, J. O.
Henry, Jr., Mr. and Mrs. Geo. J.
Herrmann, A. T.
Hicks, Lewis A.
Hill, A. P.
Hitzroth, L. D.
Holland, J. L.
Holberton, Geo. C.
Holman, Alfred
Hoolidge, Geo. H.
Hutton, Mr. and Mrs. C. W.
Jobson, Edward
Kauzee, Geo.
Knight, P. H.
Lighthipe, Mr. and Mrs. J. A.
Loeb, I.
Low, Mr. and Mrs. Geo. P.
McAdie, Prof. A. G.
Martin, John
Masson, R. S.
Meredith, Wynn
Noble, H. H.
Noble, Mr. and Mrs. J. H.
Olney, E.
Osler, M. L.
Ough, Jas.
Pennoyer, Mr. and Mrs. C. H.
Phillips, M.
Pickering, Fred M.
Poniatowski, Pce. A.
Poole, C. O.
Rea, James W.
Richards, J. E.
Rosner, Leland S.
Seifert, G. W.
Shortridge, Charles
Singletary, C.
Sloane, Chas. F.
Sprout, Sidney
Stark, Mr. and Mrs. E. E.
Sterling, Mr. and Mrs. R. H.
Stoddard, E. E.
Stone, Thomas J.
Sutcliffe, E. W.
Theberath, T. E.
Thomas, J. N.
Tiffany, Mrs.
Tutt, Mrs. I. E.
Van Frank, T. H.
Wilcox, Wilbur
Wybro, H. C.

A DESCIPLE OF THE GRAPE.

MENU

Hotel Vendome
SAN JOSE, - CAL.

SAUTERNE
Cresta Blanca

CLARET
Cresta Blanca

APOLLINARIS

CLIEQUOT

Oysters on the Shell
Consomme en Tasse
Olives Salted Almonds
Lake Trout al'Aurore
Pommes Bignon
Sliced Tomatoes Sliced Cucumbers
Vol-Au-Vent a la Financiere
Green Peas
Chicken a la Newport
Asparagus
Sorbet al'Imperiale
Squab Bardee au Cresson
Lettuce Salad
Peach Ice Cream Assorted Cakes
Fruit Napkin Rolls
Hard Crackers Roquefort Cheese
Coffee

PRECAUTIONS IN LONG-DISTANCE TRANSMISSION.

CASSIER'S Magazine very pertinently observes that in long-distance transmission work extraordinary precautions must be taken to maintain the permanance of supply. Long-distance transmission means large powers, and large powers delivered at distant points presuppose important engineering undertakings at the delivery end of the line which call for absolute continuity of supply. The poles must be selected and erected with more than ordinary care. The lines must be constantly patrolled. Trees cannot be simply trimmed, but a right of way almost as wide as a railroad right of way must be secured, and all obstructions of the nature of trees which may fall across the line in high winds must be removed. The use of the ordinary insulating materials in power houses and supply stations, such as paraffined wood and paraffined marble, must be entirely abandoned or relied upon only as minor auxiliaries, and, finally, wherever it is possible, either steam or storage battery auxiliaries at the delivery end of the line should be furnished. The engineering problem, by its very bigness, is one requiring the most careful solution at every step, and the fact that it is being now successfully carried out merits the highest praise both toward the engineers and designers, and the investors whose faith in their engineers permits the employment of the necessary capital to do the work thoroughly.

THE JOURNAL is looked forward to as one of the best papers of its class," writes Eugene J. Koppitz, of the Societe Industrielle d' Electricite Procedes Westinghouse, Paris, France.

THE JOURNAL OF
ELECTRICITY, POWER AND GAS
Devoted to the Conversion, Transmission, and Distribution of Energy.

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EDITORIAL.

GREAT LOST SECRETS.

When, in reflection, the layman wonders at the marvellous achievements which have been made in the realms of electrical engineering, and especially in electrical transmission engineering, during the past decade, he is apt to feel that science is at last almost, if not quite, in the beginning of the end of possible development. The truth is that unheard-of and undreamed-of wonders are yet to be accomplished—wonders that the keenest scientist of today may perchance brand as impossible.

But let us look backward for a moment and see just how far history will bear out a statement to the effect that engineering in general has approached its refinement.

A recent issue of the most prominent exponent of the steam engineering industry* reviews a number of interesting instances which can not do otherwise than convince even the most doubtful that engineering is today very, very far from having reached a pinnacle of perfection. Among other notes it states that it is hardly twenty years since John Waymouth, the Wolverhampton engineer and designer, discovered the motive power of heat, exhibited it in one of the simplest, cheapest and most useful engines imaginable, and then deprived the world of its benefit.

He had produced beforehand a round dozen of excellent inventions, which still bear his name, including the modern revolving chimney-cowl; and, having made a large fortune, he devoted himself to harnessing the ordinary heat of a fire, and making a new power of it. The idea was laughed at by all his friends; but, after four years of study and experimenting, he produced a stationary engine that gave double the power of any steam-driven mechanism at about a third the cost, and also a small model heat-locomotive, large enough to draw a truck with a man in it.

He invited a committee of scientists and engineers, including Prois, Huxley and Forbes Brown, and showed them that his two machines worked to perfection. The affair made a great stir, and it was proved that a great power of unlimited scope had been discovered. Waymouth was flooded with offers of huge sums for his invention, but, for no apparent reason, except, perhaps, the alleged madness of genius, he absolutely refused to either bring it out himself, or sell the secret. He announced himself satisfied with the triumph of the invention, and before his death, a year later, he destroyed all the papers and plans explaining the system, and removed the essential parts of the two engines. These engines are still possessed by his heirs, but nobody has been able to make anything of them.

Still stranger was the famous loss of the recipe for the manufacture of diamonds, some fifteen years ago. Herbert Warner, who alone discovered and held the secret of diamond making, did not live to wreck the diamond industry as people thought he would, and the circumstances of the loss were mysterious and tragic. Inferior diamonds can still be produced artificially, but only at a cost of about ten times their value. Warner, after years of experimenting, was able to turn out a genuine diamond of large size and of the first water at the cost of a small fraction of the complete stone's worth. He, like Waymouth, of heat-power fame, manufactured his diamonds before an audience of scientists and produced three fine stones, which were tested and pronounced faultless. Two of them are still in existence and are the greatest curiosities the jewel world has ever seen. But within a fortnight of this triumph, before any new stones were put on the market, Warner utterly disappeared from his house in Harley street, London, leaving no trace whatever. So complete was his disappearance that from that day to this not the smallest explanation has been hit upon.

Then there is the lost secret of the wonderful new metal, called "talium," which would certainly have been worth many millions sterling to the nation and the inventor. Grantley Adams discovered it just eight years ago, and during its short life it was one of the greatest wonders of the "science and commerce" world. "Talium" was an alloy of metals, electrically treated, nearly 55 per cent. lighter than steel, both stronger and tougher and costing 30 per cent. less to produce. It was the fruit of four years' hard work and study, and eventually Adams completed it and publicly exposed it to every kind of test.

Trains or any other vehicles, as it was proved, would be able to travel at nearly double their present speed if constructed of "talium," and there was no kind of edged tool that would not be as keen, as well as much lighter, if made of the new metal. The commotion caused by this discovery was extraordinary, and still more so was the upshot of it, for the magnitude of his success over-

*Power (New York), page 8, November, 1901.

came Adams' reason, and he became insane before ever the secret of the construction of "talium" was given out. Adams died a year later a hopeless lunitic, and, as there were no papers explaining his method, the great secret was lost. All the tools and engines of "talium" which he had made remain, but no analysis has revealed the method by which the metal was blended. "Talium" is lost.

The extraordinary "perpetual lamp" of Henry Mills, which he invented, perfected and proved the worth of twelve years ago, was lost in quite a different manner. The Mills lamp was an incandescent light, produced without any using up of materials—it had nothing to do with combustion, and the "flame" of it was perfectly cold. It was certainly one of the most wonderful inventions of the age, and not at all an expensive affair. Mills made two of these lamps and demonstrated their absolute success, but an extraordinary thing happened before the invention was put at the disposal of the public. On the night of May 20, 1899, Mills' laboratory in Hampstead was broken into, both lamps broken into fragments and all the papers describing the invention, involving years of work, stolen. There was not the slightest clew to the perpetrators of the burglary, which was done most scientifically, and the crime has never been traced. Even the reason of it is not known—whether it was malice, jealousy or theft. No use has been made of the stolen papers, and Mills, who depended on these papers, set to work again; but two months later he contracted typhoid and died, and Britain was thus deprived of his secret.

In one way it is perhaps as well that the new gunpowder, "fulmite," invented by Herbert Sawbridge six years ago, never came to a head. Sawbridge discovered this powder by accident in his little chemical experimenting room at Exeter. He perfected the powder after a good deal of study and trouble, and finally showed that in an ordinary service rifle this powder could drive a bullet accurately a distance of nearly six miles, and that at ordinary ranges it gave over ten times the penetration that "cordite," the present powder, gives. A bullet propelled by it at 600 yards would penetrate twelve men. It would have been a terribly destructive invention, and one of its best points was that it did not strain or corrode a gun in any way; and, above all, damp could not harm it. But such is the extraordinary fatality that seems to dog inventors that Sawbridge was killed in an explosion in his laboratory, which wrecked the entire cottage. This happened soon after the government had begun to negotiate with Sawbridge for the purchase of his invention; but the explosion that killed him destroyed any records there might have been of his work. It was not "fulmite" that killed him, but an accident with ordinary nitro-glycerine.

It was sheer vanity that kept Grant Finlay from giving the world the benefit of his invention for the total abolition of smoke. He evolved a simple system by which any fire or light could be made to consume its own carbon; and though he demonstrated the usefulness of the invention many times he obstinately refused to put it on the market or sell the secret of it. His own house, just outside Glasgow, was fitted with his system, which did not cost him thirty shillings for the entire building, and no jot of smoke was ever emitted there. All his fires consumed their own smoke, and he was fond of showing the efficacy of his invention to guests, but never would he explain the working of it, and he died two years ago carrying his secret with him to the grave. A week before his death he had all the "anti-smoke" apparatus stripped from his house and destroyed.

DOES TRANSMISSION PAY?

Of the financial considerations attending the completion of the system of the Bay Counties Power Company, concerning which there has been so much of doubt and trepidation in ill-informed quarters, let a few authentic figures, taken from the balance sheets of the Bay Counties Power Company, point out the moral in their own irrefutable way.

The cost of the completed property of the Bay Counties Power Company was considerably in excess of the amount originally estimated, but as the demand for its power was also much larger than anticipated, the result has not been displeasing to the owners.

The assets of the company on October 1, 1901, amounted to $6,339,442.05. Of this $2,250,000 came from the sale of first mortgage 5 per cent. 30-year sinking fund bonds, and $750,000 from second mortgage 6 per cent. bonds. Of the authorized issue of $5,000,000 of stock, 14,000 shares remain in the treasury of the company; hence 36,000 shares are outstanding, with a market value of $60. The monthly fixed charge for interest on the first mortgage bonds is $9375, on the second, $3750.

The earnings of the past six months show a steady increase:

	GROSS.	EXPENSES.	NET EARNINGS.
April 1901	$13,913.21	$4,466.35	$ 9,446.86
May 1901	16,195.76	4,590.86	11,604.90
June 1901	18,219.78	4,217.11	14,002.67
July 1901	20,903.46	6,674.15	14,229.31
August 1901	24,185.70	6,033.51	18,152.19
September...1901	25,463.52	6,864.59	18,598.93

In addition to the above gross earnings, the Bay Counties Power Company has signed contracts to supply additional customers with power amounting to $15,000 per month. Further additional income will be obtained by the sale of the remaining unsold horse power installed, calculated to amount to $10,000 per month, making a total monthly gross earning capacity of over $50,000, with an operating expenditure of not exceeding $9,000.

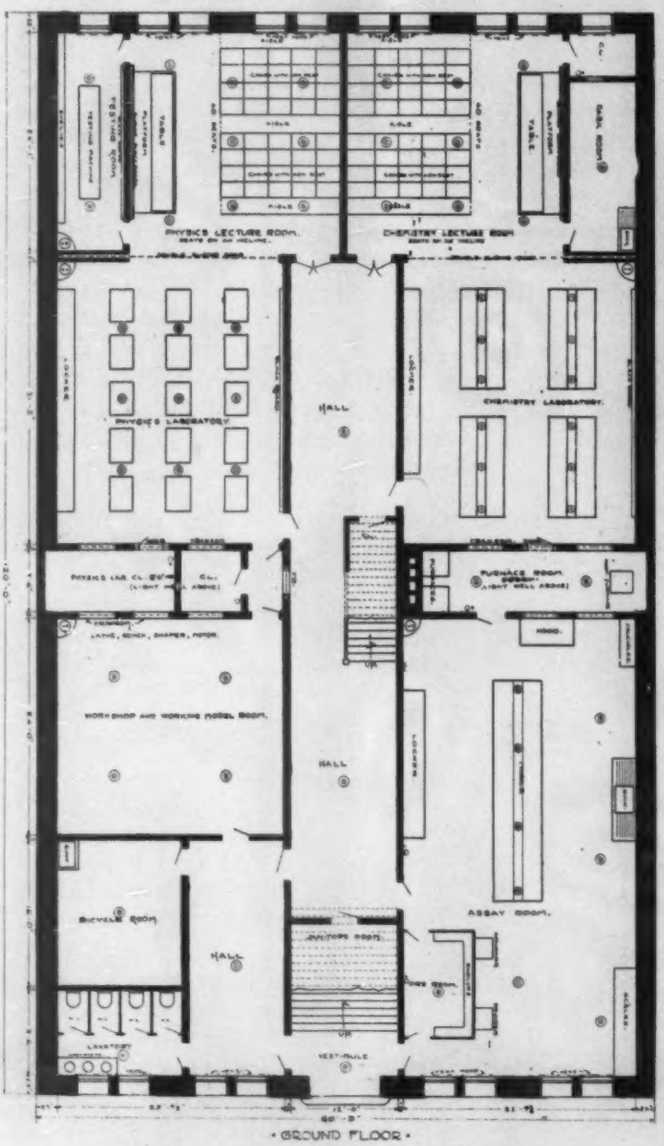
Surely then no qualification whatever is necessary to the statement that the commercial success of extremely long, high voltage transmission is no longer undemonstrated in California at least.

ENGINEERING AND ARCHITECTURAL SCHOOLS.

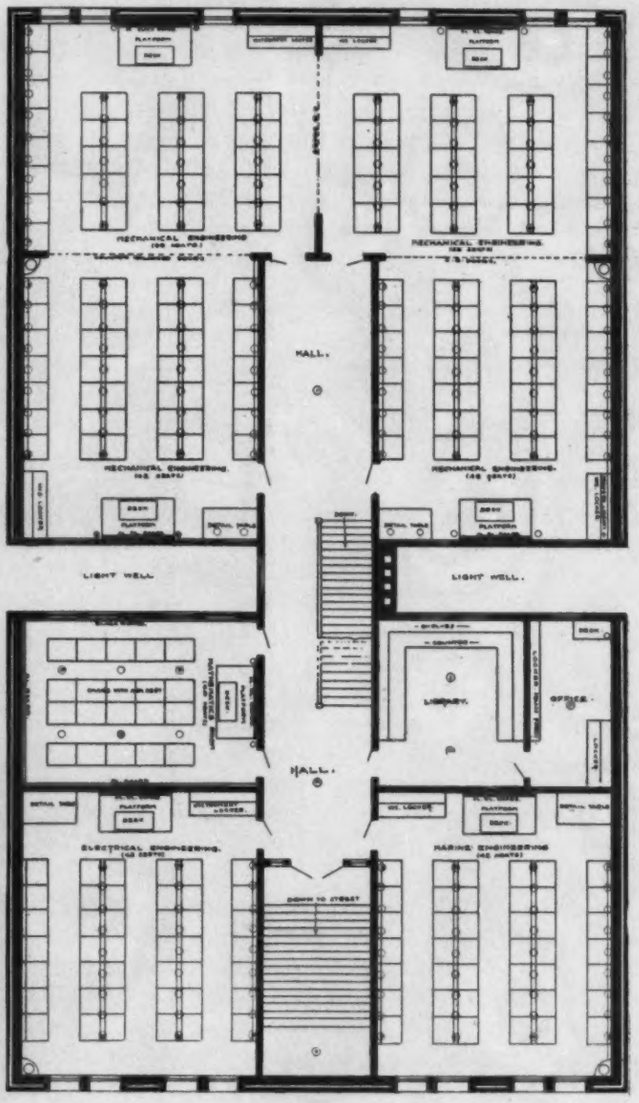
BY L. M. FORSYTH.

SAN FRANCISCO, through her natural facilities alone, occupies today the proud position of ranking among the world's great ship building centers. From a place of obscurity ten years ago she has forged ahead until now, with her great shops and ship building works, she is turning out magnificent specimens of engineering and naval architecture. New works are being established the older works are expanding, and the manufacturing interests are enjoying an era of general prosperity.

The struggle to sustain this position becomes keener every year and there is rapidly growing a conviction that if we are to retain our position we must bring up the rising generation to a greater knowledge of technical detail in the pursuits in which they are engaged. Great Britain owes her present proud position among the nations of the world to her commercial supremacy and that was achieved mainly through the technical skill of her sons, which has enabled her to command the carrying trade of the world. The conditions of today and those of fifty years ago are quite changed, and it is this altered condition of labor and the increase of territory and great commercial advantages that make it absolutely necessary that there should be fostered what is called "Technical Education."



• GROUND FLOOR •

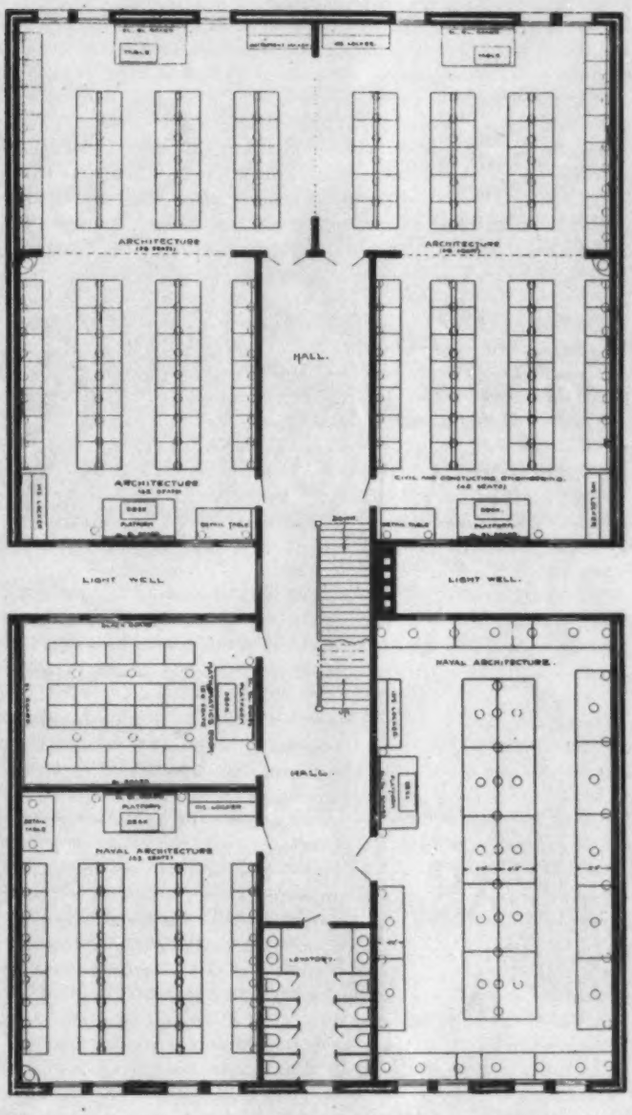


• FIRST FLOOR •

It is absolutely necessary for the people of the Cost to be educated along lines that will enable them to thoroughly understand and perpetuate the blessings which Nature has so bountifully bestowed upon them, and to acquire such education a school for technical training is established.

The greatest evening technical schools of the world are those of Glasgow, London, Edinborough, Sheffield, Newcastle and Liverpool. In these schools the youth is given the technical side of his work, the practical application of which is his business during the day. Architecture, Naval Architecture, Mechanical Engineering and Civil Engineering are here taught in their widest and broadest aspect. The United States has been slow to realize the importance of this side of its economic development, but of late years it has awakened from its lethargy and on all sides schools of this nature have arisen. Perhaps the most famous of all is Cooper Union, in New York City, with an enrollment of over 3000 pupils. The purpose of these institutions is to give the necessary theoretical training, not only to the younger apprentice, but also to the machinist, mechanic and carpenter, that they may in time rise to positions as skilled engineers or architects.

San Francisco is not behind her sister cities in the education of her youth. Many people are not aware that right in our midst is located one of the most promising departments of the public schools, and that is the drawing department of the Humboldt Evening School, on Golden Gate avenue, near Hyde street. Here



PLAN OF SECOND FLOOR

we have the only technical evening school now open to young men who follow mechanical pursuits during the day and who are anxious to employ their leisure hours in better fitting themselves for their chosen professions. Four years ago, the present head of the school realized the great need of just such an institution and persuaded the Board of Education (which was prompt to accept his suggestion) to allow him the use of the biology room of the Polytechnic High School for a class-room in Mechanical Drawing.

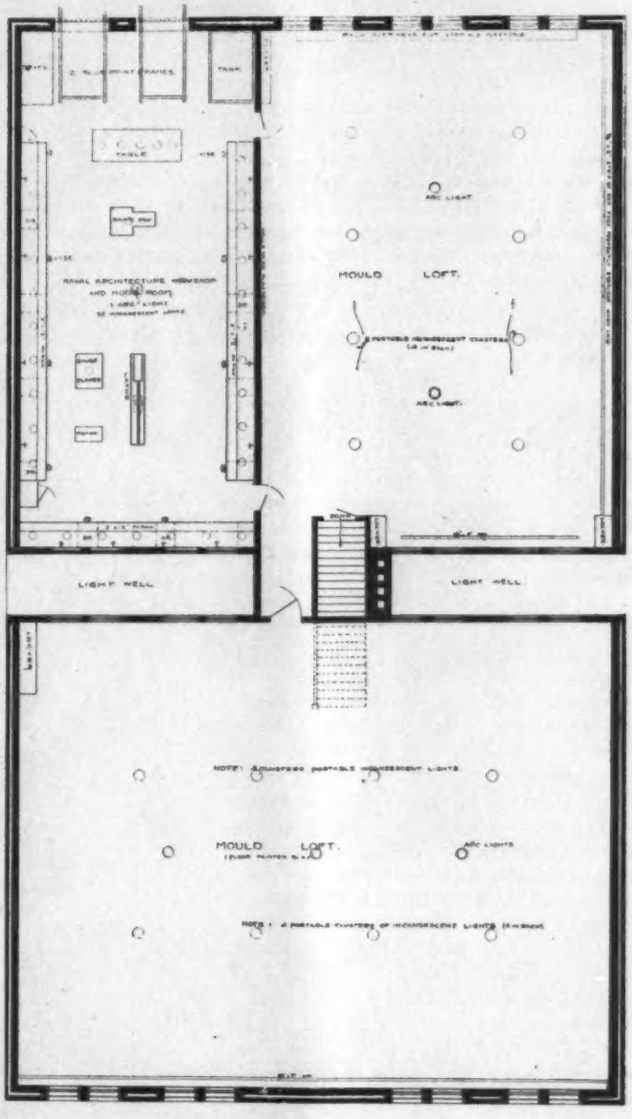
From a class of thirty-five students in one room, this department has grown until now it occupies the entire basement of the Humboldt Evening School, and has a corps of nine instructors, all of whom are engaged daily in the practical pursuits of the subject which they teach.

Today, without advertisement of any kind, it has an enrollment of nearly 300 students, and has done excellent work in the short period of its existance — namely, four years.

Again, each instructor in Mechanical Engineering Drawing is a practical designer of machinery, working at the business; each instructor in Naval Architecture and Architecture is a practical architect of experience, and also engaged at his profession. This is seldom the case. The instructors, themselves having passed through the student ages in the profession, are competent to judge what is, and what is not, necessary to know or learn. Their acquaintance with local engineering conditions existing on the Pacific Slope is also valuable for their students. The instructors have acquired their knowledge in this state, which fact provides them with a general knowledge necessary in this work.

There are six classes in Drawing, one in Physics, one in Mathematics and one in Mechanics. Courses are given in Mechanical, Electrical, Civil and Mining Engineering, Naval Architecture and Architecture. A course is also given for sea-going engineers. In its plan and organization it corresponds exactly with, and serves the same purpose as, the great evening schools of Engineering, Ship Building, Architecture and the Applied Sciences, which are to be found throughout the British Isles.

In the classes are to be found students ranging from 16 to 50 years. Special facilities are offered and consideration given to men of mature years, likewise men of family are specially provided for, so as not to deprive those desiring it of a chance to better themselves in the particular trades which they have chosen. The ordinary features of the common school, such as discipline, are entirely absent, as the classes are really associations of men seeking advancement in technical education. From this social contact is derived a strong liking and enthusiasm for the profession, and many valuable, lasting friendships are formed. A young man engaged at any of the trades may come to the school and gain information and be taught to understand and to work out drawings in his particular line.



TOP FLOOR

The student body work at their various trades all day and receive the theoretical work in the evening, thus combining practice with theory. The results of this system prove it to be unquestionably the best for making a man both theoretical and practical. The students attend regularly throughout the year, with the exception of the usual vacations. In no other portion of the United States is it possible to attend school all the year round. But here the climatic conditions are so favorable that students have the additional advantage of being able to attend both summer and winter.

Courses are not graded, which means that the student is given individual attention, and each man's case is handled separately by his instructor, with whom he comes in direct contact every evening. Thus a backward student is well taken care of.

Courses are also given in practical Arithmetic (elementary and advanced) and in so much of a working knowledge of Geometry and Algebra as is necessary for every good mechanic to have. Regular lectures in Physics, Mechanics and Electricity treat in an easy and interesting way of the first principles of mechanical motions and machines. More advanced work in Mechanics is also given, dealing with engines and boilers. In this way a student is enabled to spend from three to four nights at his drawing-board, and the remainder with one or more of the other subjects. All this is arranged for by having the student enroll in a drawing class, from which he goes to the special classes, according to the program of special studies.

The aims of this school are to develop such qualities as make master mechanics, and to give to those who are satisfied with that much, the power to read working drawings. Apprentice draughtsmen also have opportunity to enlighten themselves concerning their daily work in the drawing office.

When one wishes to solve some workshop problem which he is unable to do by himself, he has his instructor to whom he may apply to help him out of his difficulties. Naval Architecture is taught to the extent of giving a practical knowledge of designing, ship fittings and details, and laying down the lines of a ship's hull, including large ships, yachts and small boats. Some facilities and tools for constructing working models to these drawings are also at hand.

Architecture is another strong feature of this school. In this department are to be found young, aspiring architectural draughtsmen, carpenters, sheet metal workers, plumbers, and workers in all lines. The course is so arranged that the student receives a thorough knowledge of geometrical problems, the five orders—planning, designing, detailing and perspective drawing. These men receive a training which will empower them to exercise a controlling influence on the architecture of San Francisco, and to see that it will conform to scientific and artistic rules.

The Board of Education have seen fit to establish this school in order to give to the young mechanics of the city a training which they would otherwise never obtain, a training which is as much required by the mechanics as common school branches (such as arithmetic) are required by those in every-day life.

The young man in other walks of life is lost if he does not possess a "common school education" including the important branches of arithmetic. Just so, the young mechanic is far in the background if he does not possess what for him is a "common school education," namely, a good working knowledge of arithmetic, quickness at drawing, and if need be, to be able himself to make a drawing to scale. Thus the training in arithmetic and drawing go hand in hand, the one aiding the other.

Those directly benefited by this school are the young apprentice, full of good manly energy, coupled with a desire to educate his mind as well as his hand, and so to get ahead in the world, also the skilled artisan or the mechanic. The instructor's duty consists in effecting the successfu , vigorous training of those consigned to his supervision. The school has a fine stock of working drawings for use in the classroom. These drawings have come directly from all the principal workshops in the United States.

It is proposed to erect, equip and maintain a new school building to be used exclusively for students of Mechanical, Electrical, Civil and Mining Engineering, Architecture and Naval Architecture, who are engaged in the practical pursuit of those arts during the day. The maintenance of such a school would have a great bearing on the welfare of our citizens. The present school is rapidly outgrowing its present quarters and what it now needs is a model room, a mould loft, and a mining laboratory. The taxpayer has always regarded education as economical at any price. Besides, he is only carrying out his former action to its logical conclusion. If he was justified in giving a higher education to young men, who intend following professions, then surely the boys who are to maintain our superiority in technical pursuits (our future mechanics) merit advancement since they have shown themselves desirous of further advancement by attending the school which was established for their benefit, and which has outgrown its present quarters owing to their large attendance. One has but to visit this school and see the enormous attendance, the grand work being done, in order to realize the importance of new quarters, to be devoted exclusively to this work.

Reference to the accompanying plans will show what is essential at the present time. The proposed school building should be a plain, substantial and modern structure, a brick building preferred.

On the ground floor, as per plan, will be located the physics, testing, assay, dark, chemistry, working model, lecture and janitor's rooms. On the first floor will be the mathematics room, four rooms for mechanical engineering, the office and a general library.

The second floor will contain one mathematics room, two naval architecture rooms and four rooms for architecture. A large loft will be located above this floor, where a workshop will be fitted up for making models of ships, etc., and a mould loft provided for laying off lines of ships. No yard will be required, as the school will be occupied only in the evening.

The equipment should be ample and include among other things a projecting apparatus for stereoptican, photographic outfit, testing machine, surveying instruments, a few tools for working model room, and mould loft, assaying outfit, working models, class room and text book libraries, a good general technical library and a very complete line of apparatus for work in physics.

If found desirable the plans could be altered so as to include ample accommodations for a complete high school course such as exists under the present regime.

The school should be located as near as possible to the present school, for this is very satisfactory, being situated centrally and within one block of the City Hall. It can be reached with equal convenience from either the Potrero, the Mission the Western Addition, North Beach or the Southern District, in a minimum of time.

That the proposed structure will cost very little may be seen from the plans and the following:

Lot, about	$20,000
Building	40,000
Equipment, allowing for some on hand	20,000
Total	$80,000

San Francisco must not let this grand opportunity slip away for the lack of a small sum. We owe it to ourselves not to be parsimonious and throw away our opportunities when a few thousand dollars will give us an institution as fine, if not finer, than that of any other city in the world.

"THE JOURNAL is out of sight, and I would not be without it if I had to steal it," writes a prominent electrical engineer of Seattle, in renewing his subscription.

"I appreciate THE JOURNAL very much, for it contains many articles of interest to me," writes C. E. Lane of Grand Forks, B. C.

THE DEVELOPMENT OF THE LOCKE INSULATOR.

BY FRED M. LOCKE.

IN a recent letter to the writer, the editor of THE JOURNAL expressed the opinion that it would be pertinent at this time to contribute an article upon the inception and development of the type of insulator used in the system of the Standard Electric Company of California, and in that of the Bay Counties Power Company, and it is in accordance with the wish submitted by him that the following is written:

FIGURE 1—NO. 15 GLASS INSULATOR.

It was in the winter of 1883-4, while employed, jointly, by the New York Central and Hudson River Railroad and the Pennsylvania Railroad Companies, at Canandaigua, New York, that my attention was called to the need of better insulation on our telegraph lines by a rather peculiar circumstance. The principal part of my work was between Canandaigua and Harrisburg, Pa., over quite a long line, and a good share of the time the insulators were wet or damp from rain or fog, which allowed a small leakage over each insulator, and being a grounded circuit, the operator at either end, upon opening his key to answer a call, would force the entire current over the wet insulators and to ground. Thus was formed a new circuit, over which Harrisburg office could continue to call and I was unable to answer, the opening of my key affecting his relay only under very fine adjustment. The result was that my office was very frequently reported for not answering calls and to free myself from blame I quietly began an investigation.

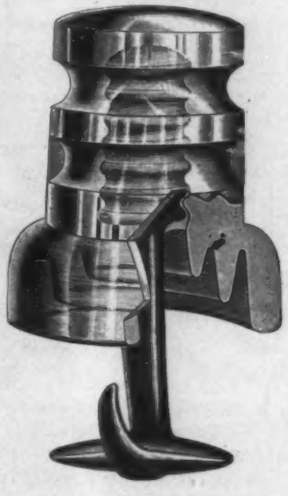


FIGURE 2—INSULATOR FOR UNDER SIDE OF CROSSARM.

I recall that when mopping the office floor, having wet shoes, and accidently touching the key when operating, part of the current would ground through me. With this in view, and interposing between my finger and the key, a wetted glass plate, I was able to crudely measure the distance over which a perceptible leakage took place; applying my tongue in place of finger I could make more delicate measurement by tasting ($30.00 per month allowed me no finer instruments) and I determined that a length of about 8 inches of wet glass surface was nearly perfect insulation for 2500 volts. In possession of this data, I designed what is now known as the No. 15, 4½-inch glass insulator, triple petticoat, an illustration of which is herewith presented. This is the first recorded designed "triple petticoat" insulator. Shortly afterward I brought out another design, which is also illustrated, and which was fitted to be received into the under side of the crossarm and fastened with wood pins or dowels, thus affording protection for the insulator.

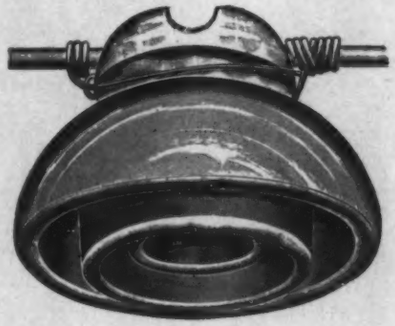


FIGURE 3—TRIPLE PETTICOAT PORCELAIN INSULATOR, ONE PIECE.

FIGURE 4—EAVE-TROUGH TYPE OF PLAIN INSULATOR.

Crude induction coils were at that time made, and glass plate machines were used by me to raise the potentials in a series of experiments then carried on to determine the best material for efficient insulators. It was soon ascertained that of all materials at hand, glass and porcelain were the two at the front. Glass showed great resistance against puncture; porcelain greater surface resistance. Porcelain, if capable of withstanding the required potential, does not deteriorate with time and use, and lose its efficiency as a dielectric, as does glass. The next insulator designed was a triple petticoat porcelain, illustrated herewith as figure 3.

FIGURE 5—SHOWING SHELL CONSTRUCTION.

FIGURE 6—INSULATOR EMBODYING TRIPLE PETTICOAT SHELL CONSTRUCTION.

Exhaustive experiments were then carried on with a view of ascertaining the best means of carrying water off from the outer top surface of insulators wet from rainfall, etc. As a result the eave-trough type was developed. Three of these designs are shown in figures 4, 8 and 9. I next decided, from my searches, as to what constituted efficient porcelain for this work, and being unable to manufacture it myself, I was forced to look to porcelain manufacturers for this product. I continued for some time to have my insulators made for me in this manner, but soon found that no reliance could be placed upon the uniformity of their ware as commonly manufactured, and that it would be necessary, for successful use of porcelain for very high voltages, to manufacture this myself. Experiments with the aid of a cook stove were first carried on; finally, with a small kiln, from the use of which I became convinced that a porcelain could be made suited to withstand almost any voltage.

FIGURE 7—NO 307 "VICTOR" PORCELAIN INSULATOR, FOR 40,000-VOLT LINE.

In this connection, it may be stated that in thick and heavy pieces, as were the first insulators, porcelain is very liable to small cracks and flaws, while thin pieces may be burned much more perfectly and thoroughly uniform and vitreous. For these mechanical, as well as electrical reasons, the shell construction was

designed, a sectional view of which is shown in figure 5, and an insulator, with this construction, is shown complete in figure 6.

Following closely after the development of high potential insulators, there was a gradual raise of the high potential point and one notable result was the new ruling in regard to the "triple petticoats," a term that is even today, in the minds of a great many users of high potentials, symbolical of the highest and best type of insulators. Now, it will be noted that up to this point the idea is dominant that the more surface embodied in the petticoats between the pin and line the better the insulators produced. But with the higher potentials, it was found that we were contending against insidious surface leakage, and thus by interposing large surfaces in the shape of petticoats in order to insulate, we presented the greatest detriment to efficient insulation. It will readily be seen that were we able to design an insulator with no surface whatsoever, and just distance between wire and pin enough to prevent arcing at potential used, we would have a perfect insulator. Consequently if we designed insulators with the required arcing distance, and with just as small a surface as possible, we then have as perfect an insulator as is possible under present usage.

FIGURE 8—No. 304 "VICTOR" COMBINATION INSULATOR FOR 60,000-VOLT LINE.

FIGURE 9—No. 304 "VICTOR" COMBINATION INSULATOR FOR 60,000-VOLT LINE.

In general, then, we may state that our best designs embody the maximum arcing distance that is possible with a minimum amount of surface, over which static discharge may take place, such insulators to be made of a material having the most favorable hygroscopic properties and the greatest surface resistance and mechanical strength. This material is porcelain, as technically developed.

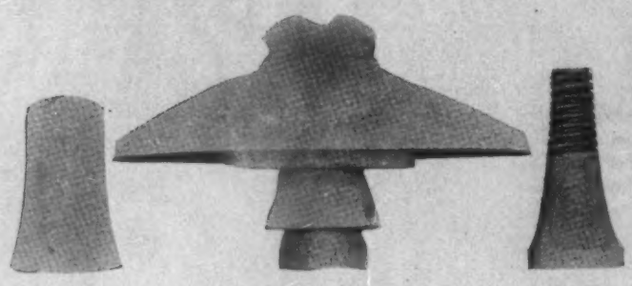


FIGURE 10—EARLY "VICTOR" TYPE INSULATOR, SHOWING CENTER.

In the "Victor" designs all of the above features are embodied. To attain the proper arcing distance, the top is extended laterally, or in an umbrella shape, and the center is extended down around the support, also preventing arcing to the pin. All other surface is cut out. Figure 10 illustrates one of the earlier of these designs and figures 7, 8 and 9 show three of the latest types.

These designs, as now built, include insulators for 10,000 to 60,000-volt, actual line potential, and we are now working out insulators for very much higher potentials, since late experiments would indicate that power transmission at potentials far above 60,000 is possible.

I think the above outline gives somewhat of the gradual development, and the cuts convey a very good idea of the designs. Of course there are, or were, very many other designs both in glass and porcelain, some of which have been retained up to the present, while others have been abandoned. The road leading up to the manufacture of modern high tension insulators is literally strewn with petticoats and broken china and glass. I also include a drawing of the No. 298 "Victor" insulator, for 20,000 volts and under.

FIGURE 11—No. 298 "VICTOR" INSULATOR FOR 20,000-VOLT LINE.

I wish to say, in closing, that I desire it clearly understood that the eave-trough insulators, of the design illustrated in figure 9 and used by the Bay Counties Power Company and the Standard Electric Company of California, are wholly of my designs and patents. The large saddle and strain insulators used in the great Carquinez span of the Bay Counties Power Company, although made by me, were wholly designed by Mr. R. H. Stirling, superintendent of the Bay Counties Power Company.

I may further add that I have good reason to believe that we will soon be able to insulate and transmit power at potentials running up to 100,000 volts, and even higher, for distances up to, say, four hundred miles.

ON THE COOLING OF TRANSFORMERS.

BY W. S. SESSIONS.

ONE of the former difficulties in the transmission of electrical power, in central and southern California, is the heating of apparatus, and especially of transformers. Various methods have been devised for the cooling of transformers. At the power house of the Mount Whitney Power Company, which is located on the Kaweah river, in Tulare county, California, and in a very warm climate, transformers of the Westinghouse oil insulated type are used. These transformers are each of 500-kilowatt capacity and are used to raise the generator potential from 440 to 17,300 volts for the line. They are built with a large radiating surface and are air cooled. But experience has shown that they become exceedingly hot during the summer months, and that some means of cooling, other than radiation to the air, must be employed. The best and easiest method thus far found for the cooling of these transformers is the method put into operation during the past summer. The oil in the transformers is pumped through long coils of iron pipe, which are placed in the tail-race in such a manner that the discharge from the water wheels plays over them, reducing the temperature well below that of the oil coming from the transformer. These cold pipes take the heat from the oil, which is returned cold to the transformers, keeping the latter much cooler than they would otherwise be.

The resulting temperatures, some of which is shown in the following table, are of interest, inasmuch as they demonstrate the fact that in a water power plant it is easy to keep the transformer temperature even below that of the surrounding atmosphere in

summer. It will be noticed that the difference between oil and air temperatures is not constant. This is due partly to the changing temperature of the water as the season advances, but mostly to varying load on the transformers. The maximum loads come on about seven P. M., and the minimum load about two A. M. daily. The maximum air temperature during the summer is about four o'clock in the afternoon. In the table of temperatures, those temperatures up to June 3rd were taken before the oil pump was started, and those between and including June 9th and June 14th were also taken while the pump was not running. After June 14th the pump was run continuously during the balance of the summer. During August the transformer load was heavy, and hence the oil temperatures were higher, but they were still quite low, as compared with those of May, when the air temperatures are also compared.

A COMPARISON OF AIR AND TRANSFORMER TEMPERATURES.
(Readings taken daily at 6 P. M.)

Day of Month	Month of May Temp.deg.Far.		Month of June Temp.deg.Far		Month of July Temp.deg.Far.		Month of Aug. Temp.deg.Far.	
	Air	Oil	Air	Oil	Air	Oil	Air	Oil
1	76°	115°	94°	130°	100°	86°	106°	104°
2	76	108	89	121	98	90	103	105
3	80	117	88	*84	91	88	100	107
4	84	117	85	76	95	97	95	108
5	85	117	90	76	104	97	98	115
6	88	122	91	83	107	90	102	116
7	88	124	91	83	101	88	104	116
8	90	126	84	76	99	90	103	116
9	90	125	83	†112	100	90	105	117
10	93	126	82	118	104	90	106	117
11	87	113	85	120	104	92	104	108
12	89	121	82	118	103	92	108	109
13	89	121	81	117	98	90	102	109
14	90	124	88	122	96	88	100	108
15	90	124	95	77	98	90	99	1 9
16	92	126	95	84	95	94	102	109
17	84	122	96	88	100	94	103	109
18	80	118	92	84	102	95	99	109
19	73	115	85	81	105	94	97	112
20	80	110	92	82	104	97	99	112
21	77	112	98	84	96	97	96	113
22	83	117	99	88	102	97	93	112
23	75	110	89	83	102	96	93	103
24	70	110	85	84	104	99	92	110
25	68	106	83	84	106	100	96	95
26	80	108	92	84	108	101	98	109
27	78	112	90	88	106	101	98	110
28	79	111	105	88	1 4	100	97	108
29	87	118	109	88	97	102	97	106
30	83	121	103	86	98	102	95	106
31	93	124	.....	.....	106	1 6	93	105

*Oil pump started June 3d and June 15th.
†Oil pump stopped June 9th.

ELEMENTS OF DESIGN IN LONG TRANSMISSIONS.*

BY F. A. C. PERRINE, D. Sc.

THE popular admiration of a big thing is not unwarranted from an engineering standpoint. The mere bigness of an engineering problem oftentimes introduces new elements into the solution. Ordinary methods of handling materials become impracticable when the size of the work passes that usually undertaken, stresses heretofore unconsidered become important and introduce great difficulties by reason of the extra precautions necessary in their consideration. Electrical transmission is no exception to this general rule, for, were it always necessary to consider all the phenomena involved in every electrical transmission, the solution of a great long distance problem would be the same as that for the smallest piece of work, since the introduction of larger figures into an equation introduces no difficulties in the solution. But this is not the case. In short distance work there are less terms in the equation than there are in long distance work, and in handling extremely high potentials we must consider not only the electrical factors of safety, but also mechanical factors of safety, for the reason that good insulations are never materials of great strength, and can be relied upon for their mechanical properties only when the mechanical strains are unimportant in comparison with the size of the insulating pieces employed. Were it not for these considerations it might be more expensive to transmit 10,000 kilowatts one hundred miles than to transmit the same amount of power a single mile, but to the competent electrician not more difficult. All of the phenomena which must be considered in short distance work are introduced into long distance problems in the same form. The difficulty in long distance transmission problems lies in the introduction of phenomena which are not new, but which, as has already been said, are important only in work of the latter class.

No new interpretation of Ohm's law becomes necessary as resistance rises and our lines become long, and the loss of energy over a wire of a given resistance due to its resistance remains unchanged, though, of course, we must always give due consideration to the false resistance effects that may be introduced by the size of the conductors employed. In the earlier transmission lines, where distances of from ten to twenty miles were considered, and voltages from 5000 to 20,000 volts employed, investors hesitated to buy the amount of conductor material necessary to reduce the losses, to amounts of the order employed in short distance work, and in consequence with resistance losses amounting to from 20 to 30 per cent. While the regulation problems were of great difficulty, the wires were small, and the false resistance, or socalled "skin effects," unnoticed. But with the continued success that has attended the introduction of long distance lines, the investors who have had sufficient courage to approach the problem of transmitting great powers over great distances have felt it unnecessary to restrict the engineers in the quantity of material, and, in consequence, the most recent systems have employed conductors of such a size as to necessitate the consideration of these phenomena a matter of no great difficulty to be sure, and one which only determines the limit of size of a single line. This problem has been further simplified by an agreement between the engineer and the investor that for permanence of supply duplicate lines seem almost necessary.

Perhaps the most important question to face in the long distance transmission is that of regulation. In working short lines, even with alternating currents, the regulation as the load changes is determined almost completely by the resistance effect. Occasionally when heavier currents are employed the self-inductive effects have to be considered, and generally the mutual induction from and to other lines becomes an important factor, though in determining the question of regulation the capacity effects are entirely unimportant.

Whether the lines are long or short, the current small or great, self induction, mutual induction, and capacity, as well as resistance are ever present as phenomena. But while with short lines the capacity is the least important of these phenomena and is so unimportant as to be absolutely unconsidered, with long distance lines it becomes the predominant factor. The importance of the capacity factor increases with the quantity of the charging current. This quantity, of course, depends upon the capacity of the circuit, the voltage employed, and the periodicity. A long distance line would be commercially unsuccessful were not the highest possible voltages used, and the usefulness of the current rises, within certain limits, with the periodicity. Accordingly, in long distance lines where periodicities are employed from which incandescent and arc lighting may be directly performed, high voltages entail very great charging currents to such an extent that in a line of 100 miles in length, operating at a voltage of fifty or 60,000 volts and a periodicity of sixteen, the charging current amounts to something in excess of 2000 kilovolt-amperes, and employs such a proportion of the capacity at the station for charging the idle lines as to make the introduction of units smaller than 2000 kilowatts invisable, and renders commercially impracticable the transmission of powers less than about 3000 kilowatts, unless the capacity effect be neutralized by the use of reactive coils.

Following the capacity in important effect on regulation is the self-induction. While the mutual induction may become another factor, it is only considered in order to be eliminated by trans-

*A paper presented at the Eighteenth Annual Convention of the American Institute of Electrical Engineers, Buffalo, August 22, 1901.

position of the wires, all of which leaves, of the three final factors involved, the resistance of the line in the most unimportant place, though in short distance work it is the determining factor. The elimination of mutual induction by transposition is generally an exceedingly simple problem, for the reason that the lines are almost invariably few in number and follow each other with constant load for considerable distances, allowing the transpositions to be readily made at or between poles where every facility is offered for making them simply. The self-inductive effects, while important, and increased by the length of the lines, are nevertheless comparatively small in reference to the total amount of power transmitted, for the reason that the high voltages decrease the quantity of current, and so far as the line is concerned, the self-induction is rather a benefit than a detriment when the loads are constant since the leading current due to capacity is relatively so large. Self-induction does indeed impair the regulation as the load changes and the more nearly the line capacity is balanced by outside inductances the more important becomes the efforts of the self-induction except where the load is absorbed by synchronous motors, rotary transformers, or other apparatus which is capable of operating with a leading power factor, in which case the line capacity may be balanced by some form of load having a constant inductance and the line inductance balanced by a leading load variable with the reactance drop along the line. Indeed, were it always possible to install long distance lines with a constant inductive load capable of neutralizing altogether the capacity effect; a variable synchronous motor or other leading load adjusted to neutralize at all times the self-induction of the line; the problem of regulation in a long distance power transmission line would be reduced to the simplicity of the regulation in short direct current transmissions. With variable loads the capacity and self-inductive effects cannot truly be said to neutralize each other for the reason that the capacity effect is constant, and the self-inductive effect variable with the load, and where a long line is loaded altogether with lagging loads the conditions for regulation are the worst possible. This will be explained later, as we now further discuss the effect of capacity. One of the most noticeable effects of capacity is its action in reference to the wave form of generators. Should a peaked electromotive force wave form be delivered by the generators to a line containing a heavy capacity, the line would usually have the effect of somewhat neutralizing the generator defects, and would furnish to the translating devices at the delivery end of the line a smoother curve than was originally delivered by the generator, but where the generator curve is a sine curve, or as is more common with modern types of generators, a curve with a slightly flattened top, the capacity tends to increase this flattening, at the same time in the current curve all harmonics are accentuated by the presence of capacity in the line and receiving circuit. The extent of this action is illustrated in figures 1 and 2, which are reproduced from oscillagraph curves taken by Prof. E. E. Farmer of the Stanford University, from the lines of the Independent Electric Light Company of San Francisco. This company is not operating a long distance transmission system, but its circuits being all underground are of a high capacity and in consequence the necessary points are illustrated by these curves. In figure 1 the smooth curve is the electromotive force curve at the generating end of the line. The rough curve being the corresponding current curve, the lines being unloaded except by reason of the capacity current. Figure 2 is the same current curve as it is found at the point distant from the power house along the cables.

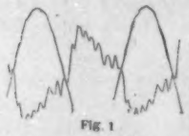


Fig. 1

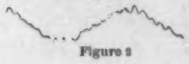


Figure 2

The peaked character of the current curves in this case seems to be due to harmonies from the armature slots in the generator, since they correspond in number and position to these slots. That this is not due to any errors in the oscillagraph itself is shown in figure 3, which gives the electromotive force curve taken with both the current and electromotive force windings of the oscillagraph in series, and shows that the two windings give corresponding results when operated by the same wave form, but displaced in phase 90°. Figure 2 shows at once by examination that the effect of the circuit has been to reduce the accentuation of the teeth of the current curve so illustrating the points made. The disadvantages that may arise from this condition were illustrated in the writer's practice in a line forty-five miles in length, operated at sixty cycles and 25,000 volts. A synchronous motor was employed having a naturally bad wave form. The maximum point of the wave rising far above the point represented by the equivalent sine wave. In this case at no load the motor took full load current and at full load current much in excess of the normal. The difficulty was remedied by paralleling the lines at the delivery end with a resistance coil. These experiments have been described in detail by the writer in a paper presented May 17, 1900, before this society. These results have been borne out more recently by observations made on a 140-mile line supplying synchronous motors of a better design, one synchronous motor being of the revolving field type, and another of the inductor type. Both of these motors give a fairly correct wave form, and in neither of them the difficulty of the earlier experiments has been repeated, fortunately proving that the difficulty from modifications of the wave form in lines due to the capacity, can be overcome by the choice of correct motors. By far the most important effect of the capacity relates to the regulation of the transformers and generators attached to the line: A leading current taken from such apparatus having the effect of increasing the voltage, while a lagging current decreases it proportionately. This has nothing to do with the drop in voltage from the line itself, whether on account of resistance or self-induction, or to the rise along the line due to the capacity, but refers only to the action of the generating apparatus, and it can readily be seen that where a line is operated sometimes with no load and sometimes at full load, the change of the power factor from leading to lagging will change the voltage beyond the calculated drop along the lines, and generally beyond the amounts allowed for in any regulating apparatus. Considering this point we see at once that the regulation difficulty that was above spoken of is due to the variability of the self-inductive effect in the line itself, and points to the conclusions that were above drawn of the perfect line being one in which the capacity of the line is neutralized by constant self-induction and the self-inductive effect of the line is neutralized by a leading load variable with the variations of the load on the line.

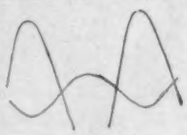


Figure 3.

With lines of high capacity there is a rise in potential along the circuit, but though this effect has produced much discussion, its practical effect in importance is not very great, for the reason that it is entirely overshadowed by its corresponding effect on the apparatus which has just been described. In the case of the longest lines at present operated, this effect does not amount to more than 20 per cent. of the rise in the step-up transformers produced by the same leading current.

As has already been said, the highest possible potentials are necessary in order to restrict the investment in very long transmission lines. When the voltages rise above 30,000 volts, phenomena become important in the problem of insulation which below that voltage were unnecessary to consider. In the first place voltages from 25,000 to 30,000 volts can be readily handled with insulators of either glass or porcelain having a diameter not exceeding seven inches. Pieces of glass or porcelain of these dimensions are mechanically strong and are readily manufactured. Where the voltage rises to 50,000 or 60,000 volts, and the sparking distance between the lines increases to between 5 and 6 inches, the insulators must have a diameter of at least 12 to 13 inches and be held not less than 7 or 8 inches above the crossarm. Such pieces of these fragile insulating materials are difficult to manufacture, and though the problem has been successfully solved, the greatest care in design and manufacture is absolutely essential, though it is believed that the factor of safety of high potential

insulators as at present designed is by no means as great as that commonly employed with the lower voltages. An even more striking difficulty in handling high voltages lies in the effect of the electrical surface tension or density which, with high voltages and small wires results in a brush discharge and high energy loss independent of leakage over the surface of the insulators, being simply an escape to surrounding bodies from the whole surface of the wire. This we believe was first taken into account by the engineers associated with the writer in carrying out high voltage work. Stated simply, it is found that the electrical tension along the line operating at 50,000 or 60,000 volts renders the use of wires smaller than about $\frac{1}{8}''$ diameter a dangerous expedient, resulting in important losses, which again points to the fact that high potential long distance transmissions cannot be successfully carried out unless the power to be transmitted is in itself large, warranting the use of conductors of great size.

The important phenomena which rise to view in carrying out the long distance problem have now been presented, and it remains only to call attention to the fact that in this long distance transmission work extraordinary precautions must be taken to maintain the permanence of supply. Long distance transmission means, as we have said, large powers; and large powers delivered at distant points presuppose important engineering undertakings at the delivery end of the line which call for absolute continuity of supply. The poles must be selected and erected with more than ordinary care. The lines must be constantly patrolled. Trees cannot be simply trimmed, but a right of way almost as wide as a railroad right of way secured, and all obstructions of the nature of trees, which may fall across the line in high winds, removed. The use of the ordinary insulating materials in power houses and supply stations, such as paraffined wood and paraffined marble, must be entirely abandoned or relied upon only as minor auxiliaries, and, finally, wherever it is possible, either steam or storage battery auxiliaries at the delivery end of the line furnished. It seems almost unnecessary to call attention to the design of the apparatus in the generating station, but it is perhaps well to mention the fact that the generator and transformer designers may aid the installing engineer very materially by paying particular attention to regulation at the lower power factors even at the cost of some efficiency, should that be necessary. The designer should always remember that regulation in long distance transmission is regulation at other than unity power factor.

The engineering problem, therefore, by its very bigness is one requiring the most careful solution at its every step, and the fact that it is being now successfully carried out merits the highest praise both toward the engineers in designing, and the investors whose faith in their engineers permits the employment of the necessary capital to do the work thoroughly.

The points made in this paper have all, at one time or another, been particularly discussed before the Institute, and the writer only ventures to bring them together in this sketch in the hope that new points of view may be attained by their discussion in relation to the whole problem.

WILLIAM MCKINLEY, HIS LIFE AND WORK, by *Gen. Charles H. Grosvenor*.

President's life long friend, comrade in war and colleague in Congress. Was near his side with other great men when his eyes were closed in death. Followed the bier to the National Capitol and to Canton. The general requires a share of the proceeds of his book to be devoted to a McKinley monument fund. Thus every subscriber becomes a contributor to this fund. Millions of copies will be sold. Everybody will buy it. Orders for the asking. Nobody will refuse. Elegant photogravure portrait of President McKinley's last picture taken at the White House. You can easily and quickly clear $1000 taking orders. Order outfit quick. Chance to prove success, secure yearly contract and become manager. Outfits free. Send 12 cents in stamps to pay expense of wrapping, packing and mailing elegant prospectus. Taking ten to fifty orders daily. 50,000 copies will be sold in this vicinity. Address, *The Continental Assembly*, Odd Fellow's Building, Sacramento, Cal.

OBITUARY.

The electrical fraternity throughout the country will be shocked to learn of the sudden death of James W. Godfrey of New York, sales manager for the India Rubber and Gutta Percha Insulating Company, which the *Western Electrician* announces to have occurred on November 9th. Mr. Godfrey, with a friend, had been taking a ride on the speedway behind his trotter, and on the homeward stretch turned into an avenue undergoing repairs. The street is poorly lighted, and in turning out to avoid a heavy team, the light runabout struck a gravel heap, on which, it is said, there was no light, and was overturned, throwing both occupants violently to the ground. Mr. Godfrey struck on his head and sustained a fractured skull and internal injuries. He was removed to the J. Hood Wright Hospital, where he died at 8 p. m. without having recovered consciousness. His wife, his daughter Pearl and a married daughter, Mrs. Archibald, were with him at the time. He had sustained a fractured skull and internal injuries. A sad feature of the affair was that the other members of his family were waiting for him at home to join a theatre party, for which he had the tickets in his pocket.

JAMES W. GODFREY.

Mr. Godfrey was born in New York September 15, 1855, and after graduating from college began a very active and successful business career. For some time he was interested in the manufacture and sale of fire arms, and to the last he was a fine judge of weapons as well as a keen sportsman. With the growth of the electrical industries came the demand for insulated wire, and he threw himself into that new branch of trade with characteristic enthusiasm. He was connected for many years with the New York Insulated Wire Company, and then formed the association with Dr. W. M. Habirshaw, which lasted until his untimely death. No representative of the industry was better known throughout the country, and it is within the bounds of propriety to say that Mr. Godfrey had a strong professional pride in all matters pertaining to the art and his position in it. He was an active participant in all the electric light conventions, aided the various electrical exhibitions with his personal and financial support, and was a member of the New York Electrical Society. He was secretary of the Dale Company, manufacturers of electric light supplies, and took an active part in building up electrical export trade, especially with the Far East. He was also a leading member of the Electrical Contractors' Association of New York. In addition to his prominent share in Masonic affairs, Mr. Godfrey was a member of the New York Athletic Club and of several of the riding and driving clubs of the city, his love of horses amounting to a passion. He leaves a widow and two daughters, one of whom is married. His nephew, Mr. Rowland Simes, son of the auditor of the *New York Herald*, has been in the electrical field for some years and has of late been associated with him in the Dale Company. The funeral exercises took place on the following Tuesday, and the interment was private. The Episcopal funeral services at Mr. Godfrey's apartments on upper Seventh Avenue were largely attended, and many beautiful floral mementoes testified to the universal esteem. A Masonic service was also conducted by Rome Lodge, to which Mr. Godfrey belonged. The sudden death of so amiable and popular a man will call for expressions of deepest sympathies extended to his saddened relatives from every portion of the country.

A WORTHY FOREIGN MISSION.

Stephen D. Field writes from Geneva, Switzerland, "Please keep on sending THE JOURNAL; it is being used to do good missionary work in this land of high waterfalls and low potentials."

ELECTRICAL CONSTRUCTION IN INDIA.

BY A. C. JEWETT.

ALTHOUGH the building of an electrical transmission in India proceeds along somewhat different lines, in many regards, than are followed in America, it is, nevertheless, by no means without unusual interest. For instance, we do all our heavy carting with elephants which, whether regarded as beasts of burden or as non-union laborers, are wonderfully intelligent animals. They will pull anything that can be put behind them on wheels, and when they have hauled their load to its destination they will turn to and help unload the wagons, while before starting they are equally ready to load it up for the long trip ahead of them.

GRANITE TELEPHONE POLE OF INDIA.

We have some odd pole lines here, too, as the enclosed photograph will show, although it is a poor one. This is a view of the telegraph line running between Bangalore and Madras, in the state of Mysore, and its poles are of solid granite slabs having a length of about 25 feet, while their cross section approximates 4x16 inches.

Bangalore, Sept. 12, 1901.

EUGENE J. KOPPITZ, late of the Shasta Electric Power Company, and more recently chief electrician of the power plant of the Trade Dollar Mines of Silver City, Idaho, situated at Swan Falls, on the Snake river, has gone to Paris, France, to join his brother, Carl Koppitz, of the Societe Industrielle d'Electricite Procedes Westinghouse.

PERSONAL.

GEORGE E. CARTER, whose genial personality is always welcome to the electrical and transmission interests of the great west, was far more widely known in the lumber business three or four years ago than he is even now in the electrical fraternity. It is hardly too much to say that he was born and bred in the lumber industry, in view of which no one could be more qualified than he to become prominent in the western electrical world as a specialist on poles for telephone, telegraph, electric lighting, railway and transmission purposes. Electrical people of the Pacific Coast first began to make his acquaintance some years ago when, as secretary of one of the largest redwood lumber companies of San Francisco, he began an active campaign in favor of the use of sawn redwood poles, the results of which are evidenced in the fact that practically all the most prominent transmission lines of the state of California, with the single noteworthy exception of the pole line of the Bay Counties Power Company, are of this variety of pole. It is, therefore, almost self-evident *why* he is so well known in the electrical field.

GEORGE E. CARTER.

As with every new industry, it takes time to become familiar with the lasting qualities of certain materials common to it. So with transmission work, it has not until recently been realized to the fullest extent that the durability of poles depends not alone upon the pole itself, but also upon local considerations. That is why a pole fitted for one character of country becomes of secondary value when used in another and different character of locality. This is where the judgment of the specialist comes in, and being a specialist, Mr. Carter has at last succeeded in consummating arrangements whereby he is in a position to furnish whatever pole experience has demonstrated to be best for use under the conditions to be imposed. To get these varieties of poles he has ransacked the timbered region of the entire west, and more than that, he has secured business connections which enable him to fill orders of whatever proportions in the quickest possible time, whether in square sawn redwood or the round cedar of Oregon.

At present Mr. Carter is established in offices in the Crocker building, San Francisco, as principal member of the firm of George E. Carter & Company, dealers in poles and cross arms, piling and railroad ties, and to whom the public is confidently commended.

TRADE LITERATURE.*

"The Service Capacity of Railway Motors" is the title of a reprint from the *Street Railway Journal* of April 6th last, appearing as Bulletin No. 4265. *General Electric Company.*

"Engine Type Generators," is the title of the latest of the truly superb series of bulletins issued by the Crocker-Wheeler Company descriptive of its direct current machinery. This bulletin (Serial No. 13) is from the pen of Mr. P. A. Bates, who recently made a business trip over the Pacific Coast, and it presents, in a very satisfying way, the principal features of engine type generators in capacities ranging up to 750 kilowatts. *Crocker-Wheeler Company.*

General Electric Bulletins: No. 4248, "Small Alternating Current Motors," from $\frac{1}{10}$ to $\frac{1}{4}$ horse power, single phase; No. 4250, "Small Direct Current Stationary Motors," type CA, from $\frac{1}{8}$ to 1 horse power; No. 4251, "Belt Driven Railway Generators;" No. 4252, "Small Plant Switchboards;" No. 4254, "The Series Alternating Current Arc Lighting System" is discussed in twenty pages of most useful and instructive descriptive matter; No. 4246, "Power Circuit Enclosed Arc Lamps" for 220 or 550 volts; No. 4247, "Sewing Machine Motors" for direct current or alternating current circuits. *General Electric Company.*

Westinghouse Bulletins: No. 1040, "Self-cooling Transformers" in large size, high voltage types for power transmission service. Complete data concerning voltages, weights of transformer, case and oil, and dimensions are included. No. 1041, "Ammeters and Voltmeters," in the round pattern; No. 1042, "Multipolar Generators and Motors" in belted types; No. 1043, "Generators and Rotaries for Electrolytic Work; "No. 1045, "Lightning Protection," discussing the subject in general, the use of arresters and choke coils on both alternating and direct current circuits, and also giving instructions for their installations. Twenty pages. *Westinghouse Electric & Mfg. Co.*

Stanley Bulletins: No. 117, descriptive of the "S. K. C. Indicating Wattmeter and Phase Indicator," which depend upon the dynamometer principle and are of the spherical coil type. No allowances have been made in the reading of the wattmeter, as it is not affected by a leading or a lagging load of any power factor, hence indicates power directly. The S. K. C. phase inductor facilitates the counteracting of leading or lagging load disturbances on a line by indicating the proper variation of the excitation of the synchronous motors connected thereto. At a glance it tells the condition of phase relation of current and electromotive forces. Where motors and lights are supplied by the same machine this instrument is of great value. By its indications the regulation of the whole system may be materially increased. *Stanley Electric Mfg. Co.*

*Catalogues mentioned in this department will be mailed gratuitously on application to the concerns publishing them. When writing, mention THE JOURNAL OF ELECTRICITY, POWER AND GAS.